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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/050,195	01/16/2002	Sang-Bom Kang	5649-912	6301
20792 7590 03/26/2007 MYERS BIGEL SIBLEY & SAJOVEC PO BOX 37428 RALEIGH, NC 27627			EXAMINER IM, JUNGHWA M	
			ART UNIT	PAPER NUMBER
			2811	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		03/26/2007	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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<b>Office Action Summary</b>	Application No. 10/050,195	Applicant(s) KANG ET AL.	
	Examiner Junghwa M. Im	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 01 December 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,3-7,13,14 and 25-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1,3-7,13,14 and 25-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                         |                                                                             |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____                                                |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>5/2006</u> .                                                   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation of “a capacitor disposed on an upper surface of the TiN contact plug opposite the substrate and comprising a lower electrode that contacts an upper surface of the TiN contact plug and an upper surface of the TiN liner layer.” It is confusing since the capacitor is formed on the substrate, not opposite the substrate.

Claim 25 recites the limitation of “the capacitor is disposed on an upper surface of the TiN plug opposite the lower conductive layer.” It is confusing since the lower conductive layer is a part of the capacitor.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 1, 3-7, 13, 25-29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. (US 5,672,542), hereinafter Chang in view of Taguwa et al. (US 6,107,190), hereinafter Taguwa and Moise et al. (US 6,534,809), hereinafter Moise.

Regarding claims 1 and 25, insofar as understood Fig.1 of Chang shows a contact plug in an insulating layer 20 having tensile stress (col. 1, lines 53-54), a TiN layer 26 surrounding the plug on contact and having compressive stress (col. 1, lines 32-33) and an ohmic layer 24 between the insulating layer and the TiN layer.

Chang discloses substantially the entire claimed device except a TiN plug. Taguwa teaches a TiN plug having a tensile stress (col. 2, lines 33-39) in lieu of W plug of Chang. It would have been obvious to one of ordinary skill in the art at the time of the invention to form a TiN plug in the device of Chang with Taguwa's teaching in order to reduced a production cost as taught in column 1, lines 57-61 of Taguwa.

The device with the teachings of Chang and Taguwa fails to show that a lower electrode of the capacitor structure contacting the upper surface of the TiN plug. Fig.1 of Moise shows a bottom electrode 124 of a capacitor 125 formed on a TiN contact plug 114 (col. 7, lines 43-50). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Moise's teaching to the device of Chang and Taguwa in order to fabricate a DRAM array with a charge storage capacitor.

Regarding claim 3, the liner of Chang inherently possesses an amorphous structure since it is deposited by CVD.

Regarding claims 4-5, Fig. 1 of Chang shows an ohmic layer, Ti 24 between the liner and the insulating layer.

Regarding claim 6, the combination of Chang/Taguwa/Mori does not explicitly disclose the thickness of the ohmic layer as claimed. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the recited range of the thickness for an ohmic layer to improve the conductivity, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding claim 7, the combination of Chang/Taguwa/Mori does not explicitly show the thickness of the liner layer as claimed. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the recited range of the thickness for an liner layer to enhance the adherence, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding claim 13, Fig.1 of Moise shows a capacitor 125 formed on a contact plug 114 and a capacitor with a lower electrode 124 made of Pt (col. 9, lines 27-39).

Regarding claim 26, Taguwa discloses a TiN plug formed by CVD (col.1, lines 57-61).

Regarding claim 27, Chang discloses a TiN layer formed by CVD (col. 3, lines 13-14). In addition, CVD, ALD, CVD AND ALD are a process designation and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 28, Chang discloses a TiN layer has an amorphous crystal structure since it is deposited by PVC.

Regarding claim 29, Chang discloses a TiN liner formed by physical vapor deposition

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(col. 3, line 13). In addition, IPVD is a process designation and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 31, Moise shows the upper conductive layer made of Pt (col.9, lines 30-33).

Regarding claim 32, Moise shows the upper conductive layer (51) comprising a lower electrode of a capacitor (col. 9, lines 27-29).

Claims 14 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Mori and Taguwa applied to claims 1 and 25 further in view of Nagasaka et al. (US 6,300,683), hereinafter Nagasaka.

Regarding claims 14 and 30, the combination of Chang/Mori/Taguwa discloses most aspects of the instant invention except a shape of the contact plug. However, Fig. 19D of Nagasaka shows a tapered contact plug 12.

It would have been obvious to one of ordinary skill in the art at the time of the invention to form a tapered contact plug of Chang/Mori/taguwa with Nagasaka's teaching in order to form the plug without cracks. It is well known in the art that it is easier to fill contact/plug openings with tapered sidewalls.

### ***Response to Arguments***

Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

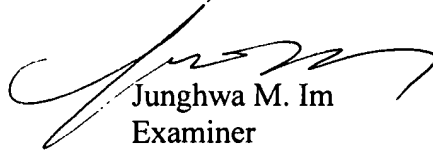
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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard T. Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
Junghwa M. Im  
Examiner  
Art Unit 2811

jmi